This expression differs from the well-known expression used by Saslow [3] and obtained neglecting $(\partial\rho/\partial T)_p$ by an additional factor $9(u + 1)^2/4$.

We substitute in (8) the expression given in [1] for η:

$$\eta = \frac{1}{S} c^2 \rho_n \tau_{ph} . \tag{9}$$

We thus obtain

$$a_1 = \frac{3}{10} (u + 1)^2 \frac{\omega^2 \tau_{ph}}{c} . \tag{10}$$

Formulas (7) and (10) coincide exactly with those obtained in [1] by solving the kinetic equation.

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QUALITATIVE FEATURES OF THE LEPTON SPECTRA IN THE PROCESS OF W-BOSON PRODUCTION IN A NEUTRINO BEAM

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A search for the intermediate W boson with mass $m \leq 4 - 6$ GeV is being planned in neutrino experiments with the accelerator of the Institute of High Energy Physics [1]. The W boson is produced in the electromagnetic field of the nucleon or nucleus in accordance with the scheme

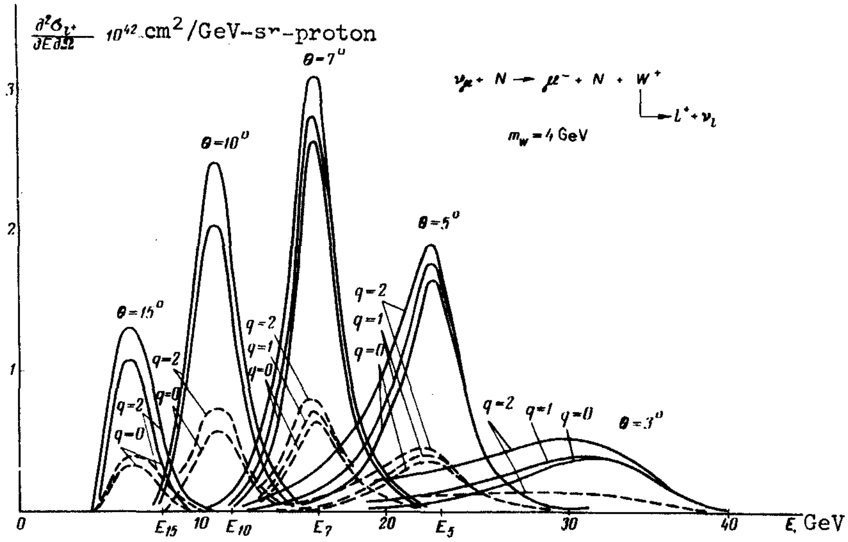
$$\nu_\mu + N \to \mu^- + W^+ + N \tag{1}$$

with subsequent decay $W^+ \to \ell^+ + \nu_\ell$ ($\ell^+ = \mu^+$ or e^+). Recent numerical calculations of the differential spectra of μ^- and ℓ^+ leptons in the reaction (1) [2] have revealed that they differ qualitatively. The physical reason for this difference was not discussed in [2].

The main contribution of the process (1) comes from the region near the minimal momentum transfers q^2. This can be readily seen by analyzing the approximate formula for the doubly-differential cross section of the process (1), obtained by the Weizsacker-Williams method [4]:

$$\frac{\partial^2\sigma}{\partial s\, \partial q^2} = \frac{\alpha z^2}{\pi} \frac{(q^2 - q^2_{min})}{q^4} F^2(q^2)\sigma_{\gamma\nu}(s)\, s^{-1}, \tag{2}$$

where $\sqrt{s}$ is the effective mass of the (μ^-W^+) system (s-system), and $\sigma_{\gamma\nu}(s)$ is the cross section of the process $\gamma + \nu \to \mu^- + W^+$. The cross section (2) has a maximum at $q^2 \simeq 2q^2_{min} \simeq s^2/2E^2_\nu$, with width $\sim 2q^2_{min}$, and the form factor is $F(q^2) \simeq 1$. In order for the amplitude of this maximum not to be cut off by the form factor, it is necessary to satisfy the inequality $3q^2_{min} \leq q^2_{el}$ ($q^2_{eff} \simeq$



Energy spectrum of ℓ^+ from the decay of W^+ with m = 4 GeV, averaged over the neutrino spectrum on a proton target (solid curve) and a neutron target (dashed) at different ℓ^+ emission angles θ and at a total W-boson magnetic moment g. The values of $E_\theta = m_W/2 \sin\theta$ are marked by strokes on the E axis.

0.71 GeV/c^2 for the incoherent process (1)), from which follows the limitation $\sqrt{s} \lesssim$ EM. The energy of W in the s-system is $E_W^s \sim m_W$, and that of the muon is $E_\mu^s \sim (2 - 3)\mu$.

The main contribution to the process (1) is due to a diagram in which exchange of virtual photons occurs between the μ^- meson and the target particle. The muon is therefore produced in the s-system in the direction of the γ-quantum momentum, but in a rather large angle interval $\theta_\mu^s \lesssim \mu/E_\mu^s$, while the W boson is produced in the direction of the neutrino momentum. The velocity of the s-system relative to the lab system, $v = |\vec{p}_\nu + \vec{q}|/(E_\nu + q_0) \simeq 1 - s/2E_\nu^2$ is directed along the neutrino lab momentum. W is therefore emitted in the lab system in a narrow cone of angles

$$\theta_W \lesssim \frac{m_W}{E_\nu}\sqrt{\frac{\mu}{m_W} \mp \frac{m_W^2}{4E_\nu^2}} \quad , \tag{3}$$

carrying away practically the entire neutrino energy, $E_W \simeq m_W/[1 - v^2]^{1/2} = m_W E_\nu/\sqrt{s} \simeq E_\nu$. In the lab system, the muon is also emitted in the direction of the neutrino beam, $\theta_\mu \lesssim \sqrt{s}/E_\nu \simeq m_W/E_\nu$, but carries away a much lower energy, $E_\mu \sim \mu E_\nu/m_W$.

By virtue of the V - A interaction in the μνW vertex, the μ^- meson is polarized predominantly in a direction opposite to its momentum in the s-system. From helicity consideration it follows that the W^+ is also polarized in a direction opposite to its momentum. This polarization is retained also in the rest system of W^+, since its velocity in the s-system is low. In this case the ℓ^+ leptons from the W^+ decays are produced essentially in a backward direction in the W^+ system. Their angular distribution is of the form

$$dN_{\ell^+} \approx \frac{3}{8}(1 - \cos\theta^*_{\ell^+})^2 \, d\cos\theta^*_{\ell^+}. \tag{4}$$

With the aid of the Lorentz transformation of the energy and of the angle into the lab system, we obtain from (4) the ℓ^+ distribution with respect to the energy and the angle in the lab system

$$dN_{\ell^+} \sim (E_\nu - E_{\ell^+})^2 dE_{\ell^+}, \quad dN_{\ell^+} \sim \frac{(1-\cos\theta_+)^2}{\left(1 - \frac{p_W}{E_W}\cos\theta_+\right)^4} \, d\cos\theta_+. \tag{5}$$

It follows from (5) that the average ℓ^+-lepton energy is $\bar{E}_{\ell^+} \simeq E_\nu/4$ and that the average angle is $\bar{\theta}_{\ell^+} \simeq 3m_W/E_\nu$.

If we change over in (4) to a distribution with respect to the transverse momentum of the lepton $p_\perp \simeq (m_W/2)\sin\theta^*_{\ell^+}$, then

$$dN_{\ell^+} \approx 3\left[\left(1 - \frac{4p_\perp^2}{m_W^2}\right)^{-1/2} + \left(1 - \frac{4p_\perp^2}{m_W^2}\right)^{1/2}\right]\frac{p_\perp dp_\perp}{m_W^2}. \tag{6}$$

The distribution (6) has a root singularity at $p_\perp = m_W/2$. Since the W^+ boson is not produced in a strictly forward direction, the distribution with respect to $p_\perp$ relative to the direction of the primary-neutrino momentum will no longer have this singularity, but a narrow maximum should appear at $p_\perp = m_W/2$. The momentum of ℓ^+ from the W^+ decay is strongly correlated with the emission angle in the lab system

$$p_{\ell^+}\sin\theta_{\ell^+} \approx m_W/2. \tag{7}$$

Relation (7) makes it possible not only to establish the existence of the W boson, but also to measure its mass more reliably than from the total cross sections of the emission of the $\mu^-\ell^+$ pairs.

We have calculated the doubly-differential cross sections for the production of μ^- and ℓ^+ leptons in the process (1) and established the following: 1) For the spectrum of the neutrinos from the accelerator of the High-energy Physics Institute at the location of the SKAT camera [3], the main contribution is made by the reaction (1) on the quasi-free protons and neutrons of the nucleus. 2) The coherent production of W on the nucleus in the case of $m_W = 4 - 6$ GeV amounts to only (8 - 3)% per nucleon. 3) The production of the hadron jet does not change the qualitative character of the spectra and makes a contribution not larger than 20 - 30%. 4) Allowance for the Fermi motion of the nucleons increases the cross section by 10 - 70% when the mass of W changes from 3 to 6 GeV. 5) Neglect of the mass of μ^- changes the total cross section by not more than 5% and increases the amplitude of the maxima in the spectra of ℓ^+ by 20 - 30%.

An example of the calculation of the spectra of ℓ^+ is shown in the figure.

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THE INVERSE PROBLEM FOR DNA

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1. To study the character of the information recorded in DNA, it is necessary to ascertain the regularity of the sequence of the nucleotides in it. In DNA, the large surface free energy V on the boundaries between long melted and helical states (MS and HS) makes it possible to determine this regularity from the melting curve of DNA with stabilizers. At $V = \infty$, the melting of DNA would correspond to a first-order phase transition at a temperature T_{tr} near which $E_\sigma = \sigma\alpha_\sigma(-T_{tr} + T)$, where E_σ is the free energy per link, $\sigma = 1$, -1, and 0 correspond to the MS, HS, and the melting point, and α_σ and T_{tr} depend on the composition of the DNA. The term independent of σ has been omitted from E_σ. At large V at the beginning of the melting, when $T > T_{AT}$[1] (where T_{AT} is the melting temperature of the homo-AT), the significant (long) sections are so enriched with the easy-melting AT pair, that the given value of T coincides with their melting temperature $\tilde{T}$, at which (taking into account the surface energy) the free energies of the MS and HS are equal. (We shall call these s-sections, and their states s-states. All the remaining sections are located below "their own" melting temperatures and, accurate to within the entropy term (see below) are helical.) The probability of such an appreciable fluctuation of the composition decreases rapidly with increasing length of the section, and therefore in the principal approximation the wings of the melting curve are determined directly by sections of definite length and composition. This indeed makes it possible to determine their probability. The accuracy of such a determination, however, has a certain limit (determined by the relative distance from T_{tr}, i.e., by the value of 1/V, and this accuracy governs the extent to which the thermodynamic quantities are independent of the detailed form of the nucleotide sequency and the solution of the inverse problem is stable.

2. We shall therefore consider only the wings of the curve (for concreteness, at $T < T_{tr}$) and only with the indicated accuracy. On the wings (see above) the change of the total free energy E' (per link) in comparison with $\tilde{E}$ for "pure" hs DNA is connected only with the appearance of the S-section. If the probability of an S-section of length λ is w_λ, with $w = \sum w_\lambda \ll 1$, then in the principal approximation such sections are independent, do not intersect, and form on the DNA a weak "solid" solution (since the sequence of the nucleotides remains unchanged). (Since $\lambda \gg 1$, we always have $w_\lambda \ll 1$, even at T_{tr}.) This

[1] AT and GC are pairs of nitrogenous bases, adenine-thiamine and guanine-cytosine, respectively; the stabilizers ("clips") are low-molecular impurities in the solution (see [1]).